Lawrence Astor
Manager, Aviation Weather Training Program
Cooperative Program for Operational Meteorology, Education and Training (COMET®)
PO Box 3000, Boulder, CO 80307-3000

# TOWARD A NATIONAL TRAINING PROGRAM IN AVIATION WEATHER: A MAJOR STEP TOWARD SAFER SKIES

## ABSTRACT

The COMET Program has created an Aviation Weather Training Alliance to support the safety improvement goals of the NASA/FAA Aviation Safety Program. This Program works toward realizing the national goal established in February 1997 by President Clinton to reduce the fatal aircraft accident rate by 80% in ten years. In this regard, the COMET Alliance is committed to the implementation and development of a national aviation weather training program and active participation in aviation safety activities that address the goal of reducing the fatal aircraft accident rate. The COMET Alliance utilizes the resources of its participants to produce innovative, result-oriented, multimedia training targeted at pilots, controllers, dispatchers, and weather forecasters.

The COMET Alliance is currently developing a unique, multimedia training prototype as the first step toward realizing a national initiative. The initial goal is to evaluate the effectiveness of aviation weather and decision-making training for regional airline pilots and for the general aviation (GA) community. This paper discusses this training initiative and pivotal project to improve pilot understanding and judgment. It describes the multimedia training architectures, initial weather content, and decision-making scenario being developed for evaluation. Examples of the user interfaces and interactive scenarios developed for the training prototype will be demonstrated.

## TRANING PROTOTYPE OVERVIEW

The COMET Alliance is presently implementing one of the initial training projects of the Aviation Safety Program. The goal is to develop a prototype and evaluate the effectiveness of interactive, multimedia aviation weather/decision-making training for regional airline pilots. The initial weather hazard chosen is icing. By completing this prototype module and its scenario, the learner will:

- Improve judgment with respect to icing conditions and aviation operations
- Improve decision-making skills with respect to icing conditions and operations
- Perform more safely in aviation operations

This is "impact" training (similar to what can occur in a flight simulator) whereby the pilot is presented with a realistic flight scenario and asked to make operational decisions as the flight unfolds. These decisions have definite consequences that determine whether the flight progresses in a safe or unsafe manner.

The prototype-training environment will be delivered to Mesa Airlines, COMAIR, and United Express for formative evaluation during August 1999. The training environment will consist of two independent workstations that can be used by pilots and airline management. A CD-ROM version of the prototype is also available. Future operations may dictate the need for multiple, networked workstations to support a dynamic simulation involving pilots, dispatchers, controllers and forecasters. The current workstation/CD-ROM has Internet Web access in order to obtain available weather resources, tools, and updates and will be networked to COMET servers for data gathering and performance monitoring.

### Design Approach

The design philosophy is to develop a robust and expandable training architecture such that it can be upgraded in capability using a pre-planned product improvement approach. It is hoped that the initial architecture will allow for the following enhancements over time:

- Additional weather hazards for integration into a given scenario
- Adaptation for GA use and evaluation
- Adaptation for military squadron use and evaluation

- Additional decision-making scenarios related to collaborative operations in the national airspace
- Performance support tools and resources

To provide the foundation upon which a collaborative, decision-making learning environment can be built, the current prototype uses an approach in which appropriate pilot and other operational dialogues are represented in the context of detailed case-scenario data elements. This can be conceived of as three components of the learning environment that can be represented as linked databases. For example, if the learners are pilots, their communication choices in relation or reaction to a situational element of the case scenario will elicit a particular "dispatcher response" from the database. Conversely, if the learners are dispatchers, their communication choices in relation or reaction to a situational element of the case scenario will elicit a particular "pilot response" from the database. The pilot, dispatcher, and case scenario elements in the database are replaceable such that this architecture allows expandability to a variety of decision-making events, evolving weather situations, or hazards.

A realistic and case-based scenario derived from an actual icing accident is used in the prototype. Successfully completing the scenario will serve as the learner post-assessment. The learning environment is rich and full of objects such as computers, flight releases, and telephones. Each object is meaningful per the scenario or treatment. Selection and use of environment objects, tools, and resources are tracked in order to provide meaningful feedback and guidance. The learning environment also provides access to tools and resources that allow the learner to achieve the instructional and scenario objectives.

The training environment is designed to meet the following functional requirements:

- Provide an interactive training product that will impact and benefit the commuter airline operation by increasing safety through sound judgment and improved decision making
- Enhance the collaborative decision-making process between pilot and dispatcher regarding aviation weather with an emphasis on icing
- Provide an interactive training product that can be absorbed into the existing training program within the airline
- Provide an interactive training product that can be expanded to include additional weather-related scenarios for commuter airlines
- Provide a performance-tracking mechanism in order to measure learner performance and capture research data

To meet these requirements, the prototype exhibits the following attributes:

- Entry assessment of learner knowledge and experience
- A decision-making scenario regarding in-flight icing conditions
- Meteorological and scientific content
- Review and analysis of decisions made
- Performance-based feedback, guidance, and direction
- Icing-related decision aids
- Post-performance evaluation and assessment

Functionality

The prototype has three distinct "modes" for the learner to use — User Guide, Resource mode, and Learning mode. The User Guide presents an interactive overview of the prototype's functionality and capabilities. The Resource mode is an information and performance support repository containing links to World Wide Web sites and a multimedia library of information on icing (called Ice Cubes). The Learning mode puts the pilot through the operational scenario where decisions must be made and judgment applied. Selected Ice Cube content is also injected into the scenario at certain points as an aide to the pilot.

Ice Cubes presents crucial and important aviation icing information in short vignettes and to-the-point topics easily assimilated and applied by the learner. Topics covered include icing impact to aircraft performance, ice type and severity, recognizing the threat of icing, identifying icing potential and contributors, and so on. An example of a multimedia Ice Cube is shown in Figure 1.

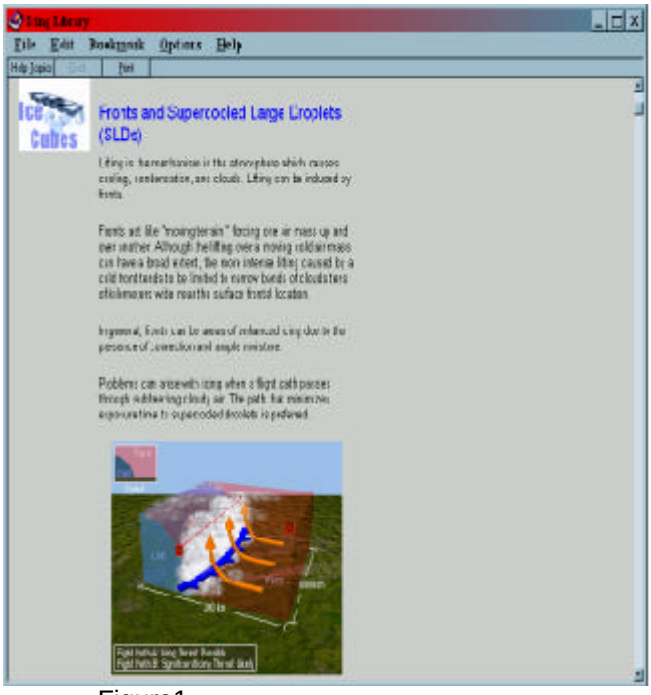


Figure1


Figure 2

TRAINING PROTOTYPE OPERATION

The learner interacts with the training environment using a simple but highly functional and interactive display. This display has status panels and a set of toggle switches on the bottom that can initiate all required actions on the part of the learner. The primary user interface is shown in Figure 2.

The learner is engaged in key and often critical aeronautical decision-making activities based upon the weather situation presented. Specifically, the learner is confronted with situations and events that require actions relating to risk management and dynamic problem solving. Depending on the choices and decisions made, the outcomes evolve and compound just as in actual flight. Several instances during the flight require recognizing clues, reacting to icing weather changes, gathering critical information, and collaborative decision making. At any given decision-making point, the following decision elements are captured and used in learner evaluation and feedback:

- Recognizing salient factors
- The type and number of cues to which the learner responds
- The sequence in which information is selected
- Balancing competing requirements or factors
- Responding to the situation in a timely manner
- Minimizing risk
- Predicting the consequences of actions, choices, etc.

Depending on the actual decisions made and the weather factors in place at the time, various outcomes – both safe and unsafe/crash – are

presented to the learner. The prototype takes the pilot through the approach and landing sequence that would occur based upon the decisions made as shown in Figure 3,


Figure 3

A debriefing evolution is then provided that will go over all the decisions made and the effectiveness of those decisions. A post-test is administered following this sequence which can be used to evaluate the learning that has taken place.

## CONCLUSIONS

It is hoped that the formative evaluation process with the regional airlines will provide the COMET Alliance, in writing, with a training evaluation and opinion on the prototype that contains the following elements:

- Affirmation of the suitability of this interactive, scenario-based approach
- Statement regarding the feasibility of incorporating this training approach in an airline's FAA certified training package
- Statement recommending the continuation of this development effort to realize a final product